

LABOR CABINET  
Department of Workplace Standards  
Kentucky Occupational Safety and Health

## **803 KAR 2:420**

### **Adoption of 29 CFR Part 1926.900-.914**

RELATES TO: KRS Chapter 338

STATUTORY AUTHORITY: KRS Chapter 13A

NECESSITY AND FUNCTION: KRS 338.051 and 338.061 authorize the Kentucky Occupational Safety and Health Standards Board to adopt and promulgate occupational safety and health rules, regulations, and standards. Express authority to incorporate by reference established federal standards and national consensus standards is also given to the board. The following regulation contains those standards to be enforced by the Division of Occupational Safety and Health Compliance in the area of construction. The standards are arranged in numerical order in order to facilitate reference to 29 CFR 1926.

**Section 1.** The Occupational Safety and Health Standards Board hereby adopts Chapter 29, Part 1926.900-.914 of the Code of Federal Regulations, revised as of July 1, 1986, published by the Office of the Federal Register, National Archives and Records Services, General Services Administration. These standards are hereby incorporated by reference with the following additions, exceptions, and deletions:

(1) The following paragraphs of 29 CFR 1926, Subpart U, "Blasting and the Use of Explosives," which were previously incorporated by reference, are hereby revised and shall read as follows:

(a) 1926.900(k)(3)(i), The prominent display of adequate signs warning against the use of mobile radio transmitters, on all roads within 1,000 feet of blasting operations. Whenever adherence to this 1,000 foot distance would create an operational handicap, a competent person shall be consulted to evaluate the particular situation, and alternative provisions may be made which are adequately designed to prevent premature firing of electric blasting caps. The competent person may be a blaster certified by the Kentucky Department of Mines and Minerals with a working knowledge of mobile radio transmission and receiving hazards as related to use of electric blasting cap firing systems and designated by the employer. A description of any alternative shall be in writing describing the unusual conditions at the site and the alternative measure used. The description shall be maintained at the construction site during the duration of the work and shall be available for inspection by representatives of the Commissioner, Kentucky Department of Labor.

(b) 1926.900(k)(4), Ensuring that mobile radio transmitters which are less than 100 feet away from electric blasting caps, in other than original containers, shall be deenergized, and have the radio transmission circuit or vehicle effectively locked against transmitter usage.

(c) 1926.900(p), The use of black powder shall be prohibited except when a desired result cannot be obtained with another type of explosive, such as in quarrying certain types of dimension stone.

(d) 1926.900(r), All electric blasts shall be fired with an electric blasting machine or properly designed electric power source, and in accordance with the provisions of subsection .906(a) and (r).

(e) The additions to 29 CFR 1926.900, "General provisions," as published in the Federal Register, Volume 58, Number 124, June 30, 1993, are incorporated by reference.

(2) The revision to 29 CFR 1926.902, "[Amended]," as published in the Federal Register, Volume 58, Number 124, June 30, 1993, is incorporated by reference.

(3) 1926.902(d), Explosives or blasting agents shall be transported in separate vehicles unless the detonators are packaged in specified containers and transported all in compliance with DOT Regulation 49 CFR 177.835(g).

(4) 29 CFR 1926.903(e), Underground Transportation of Explosives, shall be revised as follows: Revisions as published in the Federal Register, Volume 52, Number 187, September 28, 1987 are incorporated by reference. 1926.903(o) deleted.

(5) The revision to 29 CFR 1926.904, "[Amended]," as published in the Federal Register, Volume 58, Number 124, June 30, 1993, is incorporated by reference.

(6) 1926.905(h), Machines and all tools not used for loading explosives into the boreholes shall be removed from the immediate location of holes before explosives are delivered. Equipment shall not be operated within fifty (50) feet of a loaded hole except that which is required when the containment of the blast is necessary to prevent flyrock. When equipment or machinery is used to place mats, overburden, or protective material on the shot area, a competent person (who may be a blaster certified by the Kentucky Department of Mines and Minerals) shall implement adequate precautions to protect the lead wires or initiating systems such as protecting the components from direct contact with materials which sever, damage, impact, or conduct stray currents to the explosives system. This would include preventing the dragging of blasting mats or running over the holes and systems with the equipment used.

(a) 1926.905(i), No activity of any nature other than that which is required for loading holes with explosives and preparation required for initiating the blast and containment of flyrock from the blast shall be permitted in a blast area.

(b) 1926.905(k), Holes shall be inspected prior to loading to determine depth and conditions. When necessary to drill a hole in proximity to a charged or misfired hole, the distance between these two holes must be greater than the depth being drilled and precautions taken to ensure the integrity of any adjacent-charged hole or misfired hole. This distance must be determined by a competent person (who may be a blaster certified by the Kentucky Department of Mines and Minerals) in order to insure that there is no danger of intersecting the charged or misfired hole.

(c) 1926.905(n), In blasting, explosives in Fume Class I, as set forth by the Institute of the Makers of Explosives, shall be used; however, Fume Class I explosives are not required when adequate ventilation is provided and the workings are abandoned for a period of time sufficient to allow dissipation of all fumes.

(d) The addition to 29 CFR 1926.905, "Loading of explosives and blasting agents," as published in the Federal Register, Volume 58, Number 124, June 30, 1993, is incorporated by reference.

(7) 1926.906(p), The blaster shall be in charge of the blasting machines, and no other person shall connect the leading wires to the machine except under the immediate physical and visual supervision of the blaster.

(a) 1926.906(q), Blasters, when testing circuits to charged holes, shall use only blasting galvanometers equipped with a silver chloride cell especially designed for this purpose or an instrument designed solely for use in blasting, which incorporates a current-limiting device into its circuitry. No instrument capable of producing over fifty (50) milliamps on direct short circuit shall be used.

(b) 1926.906(s), Leading wires shall remain shorted and not be connected to the blasting machine or other source of current until the charge is to be fired.

(8) 1926.907(a), The use of a fuse that has been hammered or injured in any way shall be forbidden.

(9) 1926.910(b), Sufficient time shall be allowed, not less than fifteen (15) minutes in tunnels, for the smoke and fumes to leave the blasted area before returning to the shot. An inspection of the area and the surrounding rubble shall be made by the blaster to determine if all charges have been exploded before employees are allowed to return to the operation.

(10) The additions to 29 CFR 1926.914, "Loading of explosives and blasting agents," as published in the Federal Register, Volume 58, Number 124, June 30, 1993, is incorporated by reference.

**Section 2.** Public Notice.

(1) In accordance with KRS 13A.224(3)(c), this material may be inspected and copied at: Kentucky Labor Cabinet, Division of Education and Training, U.S. 127 South, Frankfort, Kentucky 40601.

(2) Office hours are 8 a.m. - 4:30 p.m. (ET), Monday through Friday.

(16 Ky.R. 717; eff. 12-15-89; Am. 20 Ky.R. 23723; eff. 05-11-94.)

**SUBPART U**  
**BLASTING & USE OF EXPLOSIVES**  
(adopted by 803 KAR 2:420)

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## 29 CFR 1926.900

### GENERAL PROVISIONS

- (a) The employer shall permit only authorized and qualified persons to handle and use explosives.
- (b) Smoking, firearms, matches, open flame lamps, and other fires, flame or heat producing devices and sparks shall be prohibited in or near explosive magazines or while explosives are being handled, transported or used.
- (c) No person shall be allowed to handle or use explosives while under the influence of intoxicating liquors, narcotics, or other dangerous drugs.
- (d) All explosives shall be accounted for at all times. Explosives not being used shall be kept in a locked magazine, unavailable to persons not authorized to handle them. The employer shall maintain an inventory and use record of all explosives. Appropriate authorities shall be notified of any loss, theft, or unauthorized entry into a magazine.
- (e) No explosives or blasting agents shall be abandoned.
- (f) No fire shall be fought where the fire is in imminent danger of contact with explosives. All employees shall be removed to a safe area and the fire area guarded against intruders.
- (g) Original containers, or Class II magazines, shall be used for taking detonators and other explosives from storage magazines to the blasting area.
- (h) When blasting is done in congested areas or in proximity to a structure, railway, or highway, or any other installation that may be damaged, the blaster shall take special precautions in the loading, delaying, initiation, and confinement of each blast with mats or other methods so as to control the throw of fragments, and thus prevent bodily injury to employees.
- (i) Employees authorized to prepare explosive charges or conduct blasting operations shall use every reasonable precaution including, but not limited to, visual and audible warning signals, flags, or barricades, to ensure employee safety.
- (j) Insofar as possible, blasting operations above ground shall be conducted between sunup and sundown.
- (k) Due precautions shall be taken to prevent accidental discharge of electric blasting caps from current induced by radar, radio transmitters, lightning, adjacent powerlines, dust storms, or other sources of extraneous electricity. These precautions shall include:
  - (1) Detonators shall be short-circuited in holes which have been primed and shunted until wired into the blasting circuit.
  - (2) The suspension of all blasting operations and removal of persons from the blasting area during the approach and progress of an electric storm;
  - (3) (i)The prominent display of adequate signs warning against the use of mobile radio transmitters, on all roads within 1,000 feet of blasting operations. Whenever adherence to this 1,000 foot distance would create an operational handicap, a competent person shall be consulted to evaluate the particular situation, and alternative provisions may be made which are adequately designed to prevent premature firing of electric blasting caps. The competent person may be a blaster certified by the Kentucky Department of Mines and Minerals with a working knowledge of mobile radio

transmission and receiving hazards as related to use of electric blasting cap firing systems and designated by the employer. A description of any alternative shall be in writing describing the unusual conditions at the site and the alternative measure used. The description shall be maintained at the construction site during the duration of the work and shall be available for inspection by representatives of the Commissioner, Department of Workplace Standards.

(ii) Specimens of signs which would meet the requirements of paragraph (k)(3) of this section are the following:

Blasting	Turn off
Zone	2-way
1000 ft	radio

About 48" x 48"      About 42" x 36"

(For illustration of signs, see printed copy)

(4) Ensuring that mobile radio transmitters which are less than 100 feet away from electric blasting caps, in other than original containers, shall be deenergized, and have the radio transmission circuit or vehicle effectively locked against transmitter usage.

(5) Compliance with the recommendations of The Institute of the Makers of Explosives with regard to blasting in the vicinity of radio transmitters as stipulated in Radio Frequency Energy-A Potential Hazard in the Use of Electric Blasting Caps, IME Publication No. 20, March 1971.

(l) Empty boxes and paper and fiber packing materials, which have previously contained high explosives, shall not be used again for any purpose, but shall be destroyed by burning at an approved location.

(m) Explosives, blasting agents, and blasting supplies that are obviously deteriorated or damaged shall not be used.

(n) Delivery and issue of explosives shall only be made by and to authorized persons and into authorized magazines or approved temporary storage or handling areas.

(o) Blasting operations in the proximity of overhead power lines, communication lines, utility services, or other services and structures shall not be carried on until the operators and/or owners have been notified and measures for safe control have been taken.

(p) The use of black powder shall be prohibited except when a desired result cannot be obtained with another type of explosive, such as in quarrying certain types of dimension stone.

(q) All loading and firing shall be directed and supervised by competent persons thoroughly experienced in this field.

(r) All electric blasts shall be fired with an electric blasting machine or properly designed electric power source, and in accordance with the provisions of subsection .906(a) and (r).

(s) Buildings used for the mixing of blasting agents shall conform to the requirements of this section.

(1) Buildings shall be of noncombustible construction or sheet metal on wood studs.

- (2) Floors in a mixing plant shall be of concrete or of other nonabsorbent materials.
  - (3) All fuel oil storage facilities shall be separated from the mixing plant and located in such a manner that in case of tank rupture, the oil will drain away from the mixing plant building.
  - (4) The building shall be well ventilated.
  - (5) Heating units which do not depend on combustion processes, when properly designed and located, may be used in the building. All direct sources of heat shall be provided exclusively from units located outside the mixing building.
  - (6) All internal-combustion engines used for electric power generation shall be located outside the mixing plant building, or shall be properly ventilated and isolated by a firewall. The exhaust systems on all such engines shall be located so any spark emission cannot be a hazard to any materials in or adjacent to the plant.
- (t) Buildings used for the mixing of water gels shall conform to the requirements of this subdivision.
- (1) Buildings shall be of noncombustible construction or sheet metal on wood studs.
  - (2) Floors in a mixing plant shall be of concrete or of other nonabsorbent materials.
  - (3) Where fuel oil is used all fuel oil storage facilities shall be separated from the mixing plant and located in such a manner that in case of tank rupture, the oil will drain away from the mixing plant building.
  - (4) The building shall be well ventilated.
  - (5) Heating units that do not depend on combustion processes, when properly designed and located, may be used in the building. All direct sources of heat shall be provided exclusively from units located outside of the mixing building.
  - (6) All internal-combustion engines used for electric power generation shall be located outside the mixing plant building, or shall be properly ventilated and isolated by a firewall. The exhaust systems on all such engines shall be located so any spark emission cannot be a hazard to any materials in or adjacent to the plant.

## **29 CFR 1926.901**

### **BLASTER QUALIFICATIONS**

- (a)** A blaster shall be able to understand and give written and oral orders.
- (b)** A blaster shall be in good physical condition and not be addicted to narcotics, intoxicants, or similar types of drugs.
- (c)** A blaster shall be qualified, by reason of training, knowledge, or experience, in the field of transporting, storing, handling, and use of explosives, and have a working knowledge of State and local laws and regulations which pertain to explosives.
- (d)** Blasters shall be required to furnish satisfactory evidence of competency in handling explosives and performing in a safe manner the type of blasting that will be required.
- (e)** The blaster shall be knowledgeable and competent in the use of each type of blasting method used.



## **29 CFR 1926.902**

### **SURFACE TRANSPORTATION OF EXPLOSIVES**

**(a)** Transportation of explosives shall meet the provisions of Department of Transportation regulations contained in 14 CFR Part 103 (1), Air Transportation; 46 CFR Parts 146-149, Water Carriers; 49 CFR Parts 171-179, Highways and Railways; 49 CFR Part 180 (2), Pipelines; and 49 CFR Parts 390-397, Motor Carriers. \_\_\_\_\_ (1) At 41 FR 15972, Apr. 15, 1976, 14 CFR Part 103 was removed. (2) At 34 FR 15473, Oct. 4, 1969, 49 CFR Part 180 was deleted and substantive portions incorporated into Part 195.

**(b)** Motor vehicles or conveyances transporting explosives shall only be driven by, and be in the charge of, a licensed driver who is physically fit. He shall be familiar with the local, State, and Federal regulation governing the transportation of explosives.

**(c)** No person shall smoke, or carry matches or any other flame-producing device, nor shall firearms or loaded cartridges be carried while in or near a motor vehicle or conveyance transporting explosives.

**(d)** Explosives, blasting agents, and blasting supplies shall not be transported with other materials or cargoes. Blasting caps (including electric) shall not be transported in the same vehicle with other explosives.  
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**(e)** Vehicles used for transporting explosives shall be strong enough to carry the load without difficulty, and shall be in good mechanical condition.

**(f)** When explosives are transported by a vehicle with an open body, a Class II magazine or original manufacturer's container shall be securely mounted on the bed to contain the cargo.

**(g)** All vehicles used for the transportation of explosives shall have tight floors and any exposed spark-producing metal on the inside of the body shall be covered with wood, or other nonsparking material, to prevent contact with containers of explosives.

**(h)** Every motor vehicle or conveyance used for transporting explosives shall be marked or placarded on both sides, the front, and the rear with the word "Explosives" in red letters, not less than 4 inches in height, on white background. In addition to such marking or placarding, the motor vehicle or conveyance may display, in such a manner that it will be readily visible from all directions, a red flag 18 inches by 30 inches, with the word "Explosives" painted, stamped, or sewed thereon, in white letters, at least 6 inches in height.

**(i)** Each vehicle used for transportation of explosives shall be equipped with a fully charged fire extinguisher, in good condition. An Underwriters Laboratory-approved extinguisher of not less than 10-ABC rating will meet the minimum requirement. The driver shall be trained in the use of the extinguisher on his vehicle.

**(j)** Motor vehicles or conveyances carrying explosives, blasting agents, or blasting supplies, shall not be taken inside a garage or shop for repairs or servicing.

**(k)** No motor vehicle transporting explosives shall be left unattended.

## **29 CFR 1926.903**

### **UNDERGROUND TRANSPORTATION OF EXPLOSIVES**

- (a) All explosives or blasting agents in transit underground shall be taken to the place of use or storage without delay.
- (b) The quantity of explosives or blasting agents taken to an underground loading area shall not exceed the amount estimated to be necessary for the blast.
- (c) Explosives in transit shall not be left unattended.
- (d) The hoist operator shall be notified before explosives or blasting agents are transported in a shaft conveyance.
- (e) Trucks used for the transportation of explosives underground shall have the electrical system checked weekly to detect any failures which may constitute an electrical hazard. A certification record which includes the date of the inspection; the signature of the person who performed the inspection; and a serial number, or other identifier, of the truck inspected shall be prepared and the most recent certification record shall be maintained on file.
- (f) The installation of auxiliary lights on truck beds, which are powered by the truck's electrical system, shall be prohibited.
- (g) Explosives and blasting agents shall be hoisted, lowered, or conveyed in a powder car. No other materials, supplies, or equipment shall be transported in the same conveyance at the same time.
- (h) No one, except the operator, his helper, and the powderman, shall be permitted to ride on a conveyance transporting explosives and blasting agents.
- (i) No person shall ride in any shaft conveyance transporting explosives and blasting agents.
- (j) No explosives or blasting agents shall be transported on any locomotive. At least two car lengths shall separate the locomotive from the powder car.
- (k) No explosives or blasting agents shall be transported on a man haul trip.
- (l) The car or conveyance containing explosives or blasting agents shall be pulled, not pushed, whenever possible.
- (m) The powder car or conveyance especially built for the purpose of transporting explosives or blasting agents shall bear a reflectorized sign on each side with the word "Explosives" in letters, not less than 4 inches in height; upon a background of sharply contrasting color.
- (n) Compartments for transporting detonators and explosives in the same car or conveyance shall be physically separated by a distance of 24 inches or by a solid partition at least 6 inches thick.
- (o) Detonators and other explosives shall not be transported at the same time in any shaft conveyance.

- (p) Explosives, blasting agents, or blasting supplies shall not be transported with other materials.
- (q) Explosives or blasting agents, not in original containers, shall be placed in a suitable container when transported manually.
- (r) Detonators, primers, and other explosives shall be carried in separate containers when transported manually.

[44 FR 8577, Feb. 9, 1979; 44 FR 20940, Apr. 6, 1979, as amended at 52 FR 36382, Sept. 28, 1987]

## **29 CFR 1926.904**

### **STORAGE OF EXPLOSIVES & BLASTING AGENTS**

- (a) Explosives and related materials shall be stored in approved facilities required under the applicable provisions of the Internal Revenue Service regulations contained in 26 CFR Part 181 (1), Commerce in Explosives. \_\_\_\_\_ (1) At 40 FR 16835, Apr. 15, 1975, 26 CFR Part 181 was transferred to 27 CFR Part 181.
- (b) Blasting caps, electric blasting caps, detonating primers, and primed cartridges shall not be stored in the same magazine with other explosives or blasting agents.
- (c) Smoking and open flames shall not be permitted within 50 feet of explosives and detonator storage magazine.
- (d) No explosives or blasting agents shall be permanently stored in any underground operation until the operation has been developed to the point where at least two modes of exit have been provided.
- (e) Permanent underground storage magazines shall be at least 300 feet from any shaft, adit, or active underground working area.
- (f) Permanent underground magazines containing detonators shall not be located closer than 50 feet to any magazine containing other explosives or blasting agents.

## 29 CFR 1926.905

### LOADING OF EXPLOSIVES OR BLASTING AGENTS

- (a) Procedures that permit safe and efficient loading shall be established before loading is started.
- (b) All drill holes shall be sufficiently large to admit freely the insertion of the cartridges of explosives.
- (c) Tamping shall be done only with wood rods or plastic tamping poles without exposed metal parts, but nonsparking metal connectors may be used for jointed poles. Violent tamping shall be avoided. The primer shall never be tamped.
- (d) No holes shall be loaded except those to be fired in the next round of blasting. After loading, all remaining explosives and detonators shall be immediately returned to an authorized magazine.
- (e) Drilling shall not be started until all remaining butts of old holes are examined for unexploded charges, and if any are found, they shall be refired before work proceeds.
- (f) No person shall be allowed to deepen drill holes which have contained explosives or blasting agents.
- (g) No explosives or blasting agents shall be left unattended at the blast site.
- (h) Machines and all tools not used for loading explosives into the boreholes shall be removed from the immediate location of holes before explosives are delivered. Equipment shall not be operated within fifty (50) feet of a loaded hole except that which is required when the containment of the blast is necessary to prevent flyrock. When equipment or machinery is used to place mats, overburden, or protective material on the shot area, a competent person (who may be a blaster certified by the Kentucky Department of Mines and Minerals) shall implement adequate precautions to protect the lead wires or initiating systems such as protecting the components from direct contact with materials which sever, damage, impact, or conduct stray currents to the explosives system. This would include preventing the dragging of blasting mats or running over the holes and systems with the equipment used.
- (i) No activity of any nature other than that which is required for loading holes with explosives and preparation required for initiating the blast and containment of flyrock from the blast shall be permitted in a blast area.
- (j) Powerlines and portable electric cables for equipment being used shall be kept a safe distance from explosives or blasting agents being loaded into drill holes. Cables in the proximity of the blast area shall be deenergized and locked out by the blaster.
- (k) **29 CFR 1926.905(k)** is amended to:  
Holes shall be inspected prior to loading to determine depth and conditions. When necessary to drill a hole in proximity to a charged or misfired hole, the distance between these two holes must be greater than the depth being drilled and precautions taken to ensure the integrity of any adjacent-charged hole or misfired hole. This distance must be determined by a competent person (who may be a blaster certified by the Kentucky Department of Mines and Minerals) in order to insure that there is no danger of intersecting the charged or misfired hole.
- (l) When loading a long line of holes with more than one loading crew, the crews shall be separated by practical distance consistent with efficient operation and supervision of crews.

**(m)** No explosive shall be loaded or used underground in the presence of combustible gases or combustible dusts.

**(n)** In blasting, explosives in Fume Class I, as set forth by the Institute of the Makers of Explosives, shall be used; however, Fume Class I explosives are not required when adequate ventilation is provided and the workings are abandoned for a period of time sufficient to allow dissipation of all fumes.

**(o)** All blast holes in open work shall be stemmed to the collar or to a point which will confine the charge.

**(p)** Warning signs, indicating a blast area, shall be maintained at all approaches to the blast area. The warning sign lettering shall not be less than 4 inches in height on a contrasting background.

**(q)** A bore hole shall never be sprung when it is adjacent to or near a hole that is loaded. Flashlight batteries shall not be used for springing holes.

**(r)** Drill holes which have been sprung or chambered, and which are not water-filled, shall be allowed to cool before explosives are loaded.

**(s)** No loaded holes shall be left unattended or unprotected.

**(t)** The blaster shall keep an accurate, up-to-date record of explosives, blasting agents, and blasting supplies used in a blast and shall keep an accurate running inventory of all explosives and blasting agents stored on the operation.

**(u)** When loading blasting agents pneumatically over electric blasting caps, semiconductive delivery hose shall be used and the equipment shall be bonded and grounded.

## **29 CFR 1926.906**

### **INITIATION OF EXPLOSIVE CHARGES - ELECTRIC BLASTING**

- (a) Electric blasting caps shall not be used where sources of extraneous electricity make the use of electric blasting caps dangerous. Blasting cap leg wires shall be kept short-circuited (shunted) until they are connected into the circuit for firing.
- (b) Before adopting any system of electrical firing, the blaster shall conduct a thorough survey for extraneous currents, and all dangerous currents shall be eliminated before any holes are loaded.
- (c) In any single blast using electric blasting caps, all caps shall be of the same style or function, and of the same manufacture.
- (d) Electric blasting shall be carried out by using blasting circuits or power circuits in accordance with the electric blasting cap manufacturer's recommendations, or an approved contractor or his designated representative.
- (e) When firing a circuit of electric blasting caps, care must be exercised to ensure that an adequate quantity of delivered current is available, in accordance with the manufacturer's recommendations.
- (f) Connecting wires and lead wires shall be insulated single solid wires of sufficient current-carrying capacity.
- (g) Bus wires shall be solid single wires of sufficient current-carrying capacity.
- (h) When firing electrically, the insulation on all firing lines shall be adequate and in good condition.
- (i) A power circuit used for firing electric blasting caps shall not be grounded.
- (j) In underground operations when firing from a power circuit, a safety switch shall be placed in the permanent firing line at intervals. This switch shall be made so it can be locked only in the "Off" position and shall be provided with a short-circuiting arrangement of the firing lines to the cap circuit.
- (k) In underground operations there shall be a "lightning" gap of at least 5 feet in the firing system ahead of the main firing switch; that is, between this switch and the source of power. This gap shall be bridged by a flexible jumper cord just before firing the blast.
- (l) When firing from a power circuit, the firing switch shall be locked in the open or "Off" position at all times, except when firing. It shall be so designed that the firing lines to the cap circuit are automatically short-circuited when the switch is in the "Off" position. Keys to this switch shall be entrusted only to the blaster.
- (m) Blasting machines shall be in good condition and the efficiency of the machine shall be tested periodically to make certain that it can deliver power at its rated capacity.
- (n) When firing with blasting machines, the connections shall be made as recommended by the manufacturer of the electric blasting caps used.
- (o) The number of electric blasting caps connected to a blasting machine shall not be in excess of its rated

capacity. Furthermore, in primary blasting, a series circuit shall contain no more caps than the limits recommended by the manufacturer of the electric blasting caps in use.

(p) The blaster shall be in charge of the blasting machines, and no other person shall connect the leading wires to the machine except under the immediate physical and visual supervision of the blaster.

(q) Blasters, when testing circuits to charged holes, shall use only blasting galvanometers equipped with a silver chloride cell especially designed for this purpose or an instrument designed solely for use in blasting, which incorporates a current-limiting device into its circuitry. No instrument capable of producing over fifty (50) milliamps on direct short circuit shall be used.

(r) Whenever the possibility exists that a leading line or blasting wire might be thrown over a live powerline by the force of an explosion, care shall be taken to see that the total length of wires are kept too short to hit the lines, or that the wires are securely anchored to the ground. If neither of these requirements can be satisfied, a nonelectric system shall be used.

(s) Leading wires shall remain shorted and not be connected to the blasting machine or other source of current until the charge is to be fired.

(t) After firing an electric blast from a blasting machine, the leading wires shall be immediately disconnected from the machine and short-circuited.



## **29 CFR 1926.907**

### **USE OF SAFETY FUSE**

- (a) Safety fuse shall only be used where sources of extraneous electricity make the use of electric blasting caps dangerous. The use of a fuse that has been hammered or injured in any way shall be forbidden.
- (b) The hanging of a fuse on nails or other projections which will cause a sharp bend to be formed in the fuse is prohibited.
- (c) Before capping safety fuse, a short length shall be cut from the end of the supply reel so as to assure a fresh cut end in each blasting cap.
- (d) Only a cap crimper of approved design shall be used for attaching blasting caps to safety fuse. Crimpers shall be kept in good repair and accessible for use.
- (e) No unused cap or short capped fuse shall be placed in any hole to be blasted; such unused detonators shall be removed from the working place and destroyed.
- (f) No fuse shall be capped, or primers made up, in any magazine or near any possible source of ignition.
- (g) No one shall be permitted to carry detonators or primers of any kind on his person.
- (h) The minimum length of safety fuse to be used in blasting shall be as required by State law, but shall not be less than 30 inches.
- (i) At least two men shall be present when multiple cap and fuse blasting is done by hand lighting methods.
- (j) Not more than 12 fuses shall be lighted by each blaster when hand lighting devices are used. However, when two or more safety fuses in a group are lighted as one by means of igniter cord, or other similar fuse-lighting devices, they may be considered as one fuse.
- (k) The so-called "drop fuse" method of dropping or pushing a primer or any explosive with a lighted fuse attached is forbidden.
- (l) Cap and fuse shall not be used for firing mudcap charges unless charges are separated sufficiently to prevent one charge from dislodging other shots in the blast.
- (m) When blasting with safety fuses, consideration shall be given to the length and burning rate of the fuse. Sufficient time, with a margin of safety, shall always be provided for the blaster to reach a place of safety.

## **29 CFR 1926.908**

### **USE OF DETONATING CORD**

- (a) Care shall be taken to select a detonating cord consistent with the type and physical condition of the bore hole and stemming and the type of explosives used.
- (b) Detonating cord shall be handled and used with the same respect and care given other explosives.
- (c) The line of detonating cord extending out of a bore hole or from a charge shall be cut from the supply spool before loading the remainder of the bore hole or placing additional charges.
- (d) Detonating cord shall be handled and used with care to avoid damaging or severing the cord during and after loading and hooking-up.
- (e) Detonating cord connections shall be competent and positive in accordance with approved and recommended methods. Knot-type or other cord-to-cord connections shall be made only with detonating cord in which the explosive core is dry.
- (f) All detonating cord trunklines and branchlines shall be free of loops, sharp kinks, or angles that direct the cord back toward the oncoming line of detonation.
- (g) All detonating cord connections shall be inspected before firing the blast.
- (h) When detonating cord millisecond-delay connectors or short-interval-delay electric blasting caps are used with detonating cord, the practice shall conform strictly to the manufacturer's recommendations.
- (i) When connecting a blasting cap or an electric blasting cap to detonating cord, the cap shall be taped or otherwise attached securely along the side or the end of the detonating cord, with the end of the cap containing the explosive charge pointed in the direction in which the detonation is to proceed.
- (j) Detonators for firing the trunkline shall not be brought to the loading area nor attached to the detonating cord until everything else is in readiness for the blast.

## 29 CFR 1926.909 FIRING THE BLAST

(a) A code of blasting signals equivalent to Table U-1, shall be posted on one or more conspicuous places at the operation, and all employees shall be required to familiarize themselves with the code and conform to it. Danger signs shall be placed at suitable locations.

(b) Before a blast is fired, a loud warning signal shall be given by the blaster in charge, who has made certain that all surplus explosives are in a safe place and all employees, vehicles, and equipment are at a safe distance, or under sufficient cover.

(c) Flagmen shall be safely stationed on highways which pass through the danger zone so as to stop traffic during blasting operations.

It shall be the duty of the blaster to fix the time of blasting.

(e) Before firing an underground blast, warning shall be given, and all possible entries into the blasting area, and any entrances to any working place where a drift, raise, or other opening is about to hole through, shall be carefully guarded. The blaster shall make sure that all employees are out of the blast area before firing a blast.

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**TABLE U-1**

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**Warning Signal** - A 1-minute series of long blasts 5 minutes prior to blast signal.

**Blast Signal** - A series of short blasts 1 minute prior to the shot.

**All Clear Signal** - A prolonged blast following the inspection of blast area.

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## **29 CFR 1926.910**

### **INSPECTION AFTER BLASTING**

- (a) Immediately after the blast has been fired, the firing line shall be disconnected from the blasting machine, or where power switches are used, they shall be locked open or in the off position.
- (b) Sufficient time shall be allowed, not less than 15 minutes in tunnels, for the smoke and fumes to leave the blasted area before returning to the shot. An inspection of the area and the surrounding rubble shall be made by the blaster to determine if all charges have been exploded before employees are allowed to return to the operation, and in tunnels, after the muck pile has been wetted down.

## **29 CFR 1926.911**

### **MISFIRES**

- (a) If a misfire is found, the blaster shall provide proper safeguards for excluding all employees from the danger zone.
- (b) No other work shall be done except that necessary to remove the hazard of the misfire and only those employees necessary to do the work shall remain in the danger zone.
- (c) No attempt shall be made to extract explosives from any charged or misfired hole; a new primer shall be put in and the hole reblasted. If refiring of the misfired hole presents a hazard, the explosives may be removed by washing out with water or, where the misfire is under water, blown out with air.
- (d) If there are any misfires while using cap and fuse, all employees shall remain away from the charge for at least 1 hour. Misfires shall be handled under the direction of the person in charge of the blasting. All wires shall be carefully traced and a search made for unexploded charges.
- (e) No drilling, digging, or picking shall be permitted until all missed holes have been detonated or the authorized representative has approved that work can proceed.

## **29 CFR 1926.912**

### **UNDERWATER BLASTING**

- (a)** A blaster shall conduct all blasting operations, and no shot shall be fired without his approval.
- (b)** Loading tubes and casings of dissimilar metals shall not be used because of possible electric transient currents from galvanic action of the metals and water.
- (c)** Only water-resistant blasting caps and detonating cords shall be used for all marine blasting. Loading shall be done through a nonsparking metal loading tube when tube is necessary.
- (d)** No blast shall be fired while any vessel under way is closer than 1,500 feet to the blasting area. Those on board vessels or craft moored or anchored within 1,500 feet shall be notified before a blast is fired.
- (e)** No blast shall be fired while any swimming or diving operations are in progress in the vicinity of the blasting area. If such operations are in progress, signals and arrangements shall be agreed upon to assure that no blast shall be fired while any person is in the water.
- (f)** Blasting flags shall be displayed.
- (g)** The storage and handling of explosives aboard vessels used in underwater blasting operations shall be according to provisions outlined herein on handling and storing explosives.
- (h)** When more than one charge is placed under water, a float device shall be attached to an element of each charge in such manner that it will be released by the firing. Misfires shall be handled in accordance with the requirements of 1926.911.

## **29 CFR 1926.913**

### **BLASTING IN EXCAVATION WORK UNDER COMPRESSED AIR**

- (a) Detonators and explosives shall not be stored or kept in tunnels, shafts, or caissons. Detonators and explosives for each round shall be taken directly from the magazines to the blasting zone and immediately loaded. Detonators and explosives left over after loading a round shall be removed from the working chamber before the connecting wires are connected up.
- (b) When detonators or explosives are brought into an air lock, no employee except the powderman, blaster, lock tender and the employees necessary for carrying, shall be permitted to enter the air lock. No other material, supplies, or equipment shall be locked through with the explosives.
- (c) Detonators and explosives shall be taken separately into pressure working chambers.
- (d) The blaster or powderman shall be responsible for the receipt, unloading, storage, and on-site transportation of explosives and detonators.
- (e) All metal pipes, rails, air locks, and steel tunnel lining shall be electrically bonded together and grounded at or near the portal or shaft, and such pipes and rails shall be cross-bonded together at not less than 1,000-foot intervals throughout the length of the tunnel. In addition, each low air supply pipe shall be grounded at its delivery end.
- (f) The explosives suitable for use in wet holes shall be water-resistant and shall be Fume Class 1.
- (g) When tunnel excavation in rock face is approaching mixed face, and when tunnel excavation is in mixed face, blasting shall be performed with light charges and with light burden on each hole. Advance drilling shall be performed as tunnel excavation in rock face approaches mixed face, to determine the general nature and extent of rock cover and the remaining distance ahead to soft ground as excavation advances.

## 29 CFR 1926.914

### DEFINITIONS APPLICABLE TO THIS SUBPART

(a) "**American Table of Distances**" (also known as *Quantity Distance Tables*) means American Table of Distances for Storage of Explosives as revised and approved by the Institute of the Makers of Explosives, June 5, 1964.

(b) "**Approved storage facility**" - A facility for the storage of explosive materials conforming to the requirements of this part and covered by a license or permit issued under authority of the Internal Revenue Service. (See 26 CFR Part 181.(1)) \_\_\_\_\_ (1) At 40 FR 16835, Apr. 15, 1975, 26 CFR Part 181 was transferred to 27 CFR Part 181.

(c) "**Blast area**" - The area in which explosives loading and blasting operations are being conducted.

(d) "**Blaster**" - The person or persons authorized to use explosives for blasting purposes and meeting the qualifications contained in 1926.901.

(e) "**Blasting agent**" - A blasting agent is any material or mixture consisting of a fuel and oxidizer used for blasting, but not classified an explosive and in which none of the ingredients is classified as an explosive provided the furnished (mixed) product cannot be detonated with a No. 8 test blasting cap when confined. A common blasting agent presently in use is a mixture of ammonium nitrate (NH<sub>4</sub>NO<sub>3</sub>) and carbonaceous combustibles, such as fuel oil or coal, and may either be procured, premixed and packaged from explosives companies or mixed in the field.

(f) "**Blasting cap**" - A metallic tube closed at one end, containing a charge of one or more detonating compounds, and designed for and capable of detonation from the sparks or flame from a safety fuse inserted and crimped into the open end.

(g) "**Block holing**" - The breaking of boulders by firing a charge of explosives that has been loaded in a drill hole.

(h) "**Conveyance**" - Any unit for transporting explosives or blasting agents, including but not limited to trucks, trailers, rail cars, barges, and vessels.

(i) "**Detonating cord**" - A flexible cord containing a center core of high explosives which when detonated, will have sufficient strength to detonate other cap - sensitive explosives with which it is in contact.

(j) "**Detonator**" - Blasting caps, electric blasting caps, delay electric blasting caps, and nonelectric delay blasting caps.

(k) "**Electric blasting cap**" - A blasting cap designed for and capable of detonation by means of an electric current.

(l) "**Electric blasting circuitry**" -

(1) *Bus wire*. An expendable wire, used in parallel or series, in parallel circuits, to which are connected the leg wires of electric blasting caps.



(2) *Connecting wire*. An insulated expendable wire used between electric blasting caps and the leading wires or between the bus wire and the leading wires.

(3) *Leading wire*. An insulated wire used between the electric power source and the electric blasting cap circuit.

(4) *Permanent blasting wire*. A permanently mounted insulated wire used between the electric power source and the electric blasting cap circuit.

(m) **"Electric delay blasting caps"** - Caps designed to detonate at a predetermined period of time after energy is applied to the ignition system.

(n) **"Explosives"**

(1) Any chemical compound, mixture, or device, the primary or common purpose of which is to function by explosion; that is, with substantially instantaneous release of gas and heat, unless such compound, mixture or device is otherwise specifically classified by the U.S. Department of Transportation.

(2) All material which is classified as Class A, Class B, and Class C Explosives by the U.S. Department of Transportation.

(3) Classification of explosives by the U.S. Department of Transportation is as follows:

Class A Explosives. Possessing detonating hazard, such as dynamite, nitroglycerin, picric acid, lead azide, fulminate of mercury, black powder, blasting caps, and detonating primers.

Class B Explosives. Possessing flammable hazard, such as propellant explosives, including some smokeless propellants.

Class C Explosives. Include certain types of manufactured articles which contain Class A or Class B explosives, or both, as components, but in restricted quantities.

(o) **"Fuse lighters"** - Special devices for the purpose of igniting safety fuse.

(p) **"Magazine"** - Any building or structure, other than an explosives manufacturing building, used for the storage of explosives.

(q) **"Misfire"** - An explosive charge which failed to detonate.

(r) **"Mud-capping"** (sometimes known as bulldozing, adobe blasting, or dobying). The blasting of boulders by placing a quantity of explosives against a rock, boulder, or other object without confining the explosives in a drill hole.

(s) **"Nonelectric delay blasting cap"** - A blasting cap with an integral delay element in conjunction with and capable of being detonated by a detonation impulse or signal from miniaturized detonating cord.

(t) **"Primary blasting"** - The blasting operation by which the original rock formation is dislodged from its natural location.

(u) **"Primer"** - A cartridge or container of explosives into which a detonator or detonating cord is inserted or attached.

(v) "**Safety fuse**" - A flexible cord containing an internal burning medium by which fire is conveyed at a continuous and uniform rate for the purpose of firing blasting caps.

(w) "**Secondary blasting**" - The reduction of oversize material by the use of explosives to the dimension required for handling, including mudcapping and blockholing.

(x) "**Stemming**" - A suitable inert incombustible material or device used to confine or separate explosives in a drill hole, or to cover explosives in mud-capping.

(y) "**Springing**" - The creation of a pocket in the bottom of a drill hole by the use of a moderate quantity of explosives in order that larger quantities of explosives may be inserted therein.

(z) "**Water gels, or slurry explosives**" - A wide variety of materials used for blasting. They all contain substantial proportions of water and high proportions of ammonium nitrate, some of which is in solution in the water. Two broad classes of water gels are: (1) Those which are sensitized by a material classed as an explosive, such as TNT or smokeless powder, and (2) those which contain no ingredient classified as an explosive; these are sensitized with metals such as aluminum or with other fuels. Water gels may be premixed at an explosives plant or mixed at the site immediately before delivery into the bore hole.

(aa) **Semiconductive hose.** Semiconductive hose—A hose with an electrical resistance high enough to limit flow of stray electric currents to safe levels, yet not so high as to prevent drainage of static electric charges to ground; hose of not more than 2 megohms resistance over its entire length and of not less than 5,000 ohms per foot meets the requirement.